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Edwin F. Johnson

MEMOIR

OF

EDWIN FERRY JOHNSON,

CIVIL ENGINEER.

PRINTED BY
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NOTES.

The Johnsons settled in this country early in the seventeenth century, in the vicinity of Andover, Massachusetts. Timothy Johnson, born in 1677, was owner of the largest property in that town, and was a "captain of mounted men." Benjamin Johnson, son of Asa Johnson, and grandson of the above, was born in 1744. He was an officer in the War of Independence, and served under General Stark at Bennington, and in several other engagements. His sister married Mr. Franklyn, and her daughter, Maria Franklyn, was the first wife of Governor De Witt Clinton. Another daughter married Genet, the French Minister to the United States.

Benjamin Johnson married Elizabeth Boardman. His son, John Johnson, was born December 2, 1771.

John Johnson married Rachel Ferry, of Granby, Massachusetts, March 3, 1799. His son, Edwin Ferry Johnson, was born May 23, 1803.

Edwin Ferry Johnson married Charlotte Shaler, of Middletown, Connecticut, September 7, 1830.

The ancestors of the Ferry family were Huguenots. Three brothers came to America between 1650 and 1675. Charles Ferry settled in Springfield, Massachusetts. His son Noah, born in 1712, settled in Granby, in the same State. Daniel, the second son of Noah, was born in 1742. His daughter, Rachel Ferry, married John Johnson in 1799.

The Ferry family in Michigan are the descendants of W. M. Ferry, who died December 30, 1867, and who was the son of Noah Ferry, the brother of Daniel Ferry, the father of Mrs. John Johnson.

PART I.

1803 to 1829.

EDWIN FERRY JOHNSON.

Edwin Ferry Johnson was born in Essex, Vermont, on the 23d of May, 1803, and was the third child of John and Rachel Ferry Johnson.

John Johnson at that time lived in a log house near Hubbell's Falls, on the north side of the Winooski, or, as it was sometimes called, the Onion River, where he owned a saw-mill and a large tract of valuable white-pine timber land.

His occupation was that of land surveyor, in which he ranked among the foremost of his time. He was employed in many public and private surveys, and held the position of Surveyor-General of Vermont. When not engaged in surveying, or in his many private duties and enterprises, he gave plans and estimates of buildings, including mills and dwellings, dams, bridges, etc., and superintended their erection, or entered into contracts for their construction.

During the first four years after the birth of Mr. Johnson nothing occurred to break the usual monotony of a settler's life in Northern Vermont. His

mother died in 1805, when he was too young to appreciate his loss, and his father married again not long after. At the age of five he met with a severe accident, through the carelessness of a neighbor, in whose charge he had been left, by which one leg was badly injured, and he barely escaped losing both, a result which would, at his age, have in all probability proved fatal.

In 1809 his father moved to Burlington, Vermont, and here the remaining years of his boyhood were passed. During 1810 and 1811 he attended school at Winooski Falls.

In 1812 war was declared between the United States and England, and the position of Burlington, not far from the frontier line of Vermont and Canada, made it the scene of many exciting incidents, which are very graphically described in Mr. Johnson's reminiscences, but which would be out of place here. In the summer of this year he came near losing his life by an incident which is worth recording, not only as a warning, but also because its consequences followed him through all his after-life, causing him at the time intense suffering, and making the active pursuit of his profession in after-years often difficult, sometimes impossible. It seems that some sort of a celebration had taken place in Burlington, during which an ox had been roasted whole on the college green, and the boys of

the village, as usual, had enjoyed their share of the sport and the good things.

The day had been hot, and he, then about nine years old, started, with three or four others, for a swim in the lake, about a mile distant. They ran the entire distance, plunged, heated as they were, into the cool waters of the lake, and remained in for two hours. One died, a cripple, within three years, from the effects of this exposure, and all had more or less reason to remember that day through life.

Mr. Johnson suffered very severely in the shoulder and ankle. Suppuration took place, the bone exfoliating, and splinters finding their way to the surface at times for more than two years after. The limbs and joints never recovered their normal strength, and all his life gave him trouble by becoming the seat of colds and rheumatic affections. His ankle remained stiff, and his left arm never became strong. He was never after able to lift his left hand higher than the top of his head. During this year, when able, he pursued his studies at home. At the age of ten he began the study of Latin with the Rev. Mr. Clark, the Unitarian minister. His father at this time held the office of town clerk, and in 1813 moved all his family and valuables to a small log house in the country, in order to insure their safety in the event of a successful advance of the British troops, then massing in Canada for the as-

cent of the lake. This was after the Eagle affair, and during the short period that the English held partial control of Lake Champlain.

In this retreat the future engineer showed his early love for the profession by the building of miniature dams, bridges, and mills upon a neighboring brook, showing intelligence and skill in model and construction.

In 1814 occurred the victory of Commodore McDonough, and the repulse of the English forces under General Prevost at Plattsburgh. These events assured the safety of the frontier, and shortly after, the Treaty of Ghent put an end to the war, and the family returned to their home in Burlington.

His father had been a firm advocate and active supporter of the war, and had furnished the government and its officers with maps and other important data, and with personal information and advice; and his house had been the headquarters of all the prominent officials. His time and means he gave without thought of recompense, save the reward of an approving judgment and conscience. His patriotism was in some sense hereditary, his own father having fought on the side of the colonists throughout the War of Independence.

In 1815, Mr. John Johnson was appointed one of the United States commissioners for the investigation and settlement of claims against the govern-

ment for the transportation of troops, supplies, etc., in this section; a duty carefully and satisfactorily performed, and which occupied much of his time and attention for nearly two years.

During the year 1816, Mr. Johnson continued his studies in the public schools and in his father's office. His father often had with him two or more young men, qualifying themselves for the work of civil engineering, and Mr. Johnson, though still quite young, by listening to the conversations and instructions, became interested, and acquired, by his own efforts, with this assistance, a very good knowledge of arithmetic, geometry, and plane trigonometry.

In the year 1817 the United States government appointed commissioners, as provided for in the Treaty of Ghent, who, in conjunction with a similar commission appointed by Great Britain, were to locate the boundary-line between the United States and the British Provinces. John Johnson was selected to take charge of the survey of that portion from the "northwest head of the Connecticut River to the Bay of Fundy;" and he left home early in the season with a party for the discharge of that duty.

During his father's absence, Edwin, then fourteen years old, took charge of his business and other interests at Burlington. He had a barn to build, the farm to oversee, and some important business, connected with his father's affairs as commissioner for

the settlement of claims against the government, to conclude.

He had already acquired some skill as a land surveyor, and ran lines, and made partitions of land in several cases, for which he charged and received his father's usual remuneration of three dollars per day. He also continued his Latin studies under Professor Burgess, of the University of the State of Vermont, and from this time he supported himself.

In the fall of 1817 his father returned from the season's work, and the winter was passed in the preparation of his report and of the maps, and the revision of the field calculations, in all which his son greatly assisted. He revised all the calculations for latitude, variation, etc., and, as he himself says, "added thereby very much to my stock of knowledge." This winter also he made drawings from nature for the first time, an art in which he afterwards became quite skilful.

In the spring of 1818, at the age of fifteen, his father took him with him on the boundary survey as assistant. The party journeyed to Quebec, where a schooner was chartered, the necessary supplies placed on board, and the men embarked for a trip of one hundred and twenty miles down the St. Lawrence. The vessel was caught in a severe storm, the deck-load of provisions swept overboard, and, after a narrow escape from destruction in the

breakers during the succeeding night, she was driven ashore on Grove Island. Fortunately, she lay on a sandy beach, and not being seriously injured, was floated off at high tide the next day, and reached her destination in safety. A brief sketch of his season's work must suffice, and it is given principally to mark the advance he had made at the age of fifteen.

He assisted in the survey of the thirty-six miles of portage between the St. Lawrence River and Lake Temiscouatta. He made also a rough survey of the route through that lake and down the Madawasca and St. John's Rivers to the Madawasca settlement, which he corrected and completed on his return.

In addition to his share of the field-work, he had charge of the astronomical observations. These observations were very frequent, often nightly, and, following the hard work of the day, were a great tax upon his endurance. Explorations of the principal branches of the St. John's were made, in all which he took an active part. In charge of a party detailed for the purpose, he made a survey of the St. John's River from the Madawasca settlement to the Grand Falls; of the Green River branch of the St. John's to Lake St. Francis; and of some minor portions of the work. He became unusually expert with the canoe, and a very good woodman. His health seemed to be fully re-established, and he

bore the labor and privation incident to such an exploration better than most of the party, despite the stiffness of his shoulder and ankle.

In 1819 his father rebuilt his mills at Hubbell's Falls, and built a new dam. He also erected one of the largest and best grist-mills in the country, from which the City Mills at Utica, New York, were afterwards modelled. His son aided in the building of the mills, and made a resurvey of a portion of the town of Colchester in the month of March, part of the time in deep snow, walking six miles to and from his work every day.

He was now sixteen years old, had got his full height and weight, and was unusually strong and active. He was noted for his skill in the athletic sports in which the young men of the country engaged at the old-time "raising-bees." It is reported of him, that he "could hold out a United States musket in one hand by the muzzle for thirty seconds."

He was engaged with his father in 1820 in furnishing large quantities of lumber to the Quebec market, in making surveys, and in prosecuting his studies at every available opportunity. In the fall he made a resurvey of a large tract of land in Highgate for the Messrs. Keyes.

The winter of 1820–21 was spent in the employ of Mr. George Moore, aiding in his shop, and in the

rafting of lumber. In April he undertook to take a large raft from the Missisquoi River to Quebec. This he performed satisfactorily, carrying the raft to Rouse's Point, St. John's, through the Chambly Rapids to Lake St. Peter, and through that to the St. Lawrence River and to Quebec. He devoted his leisure-time this year to the study of French, natural philosophy, and particularly to chemistry.

In 1822 his father turned his attention to the west side of the lake and the development of the iron interests of Keeseville, and his son took charge of the mills at Hubbell's Falls, practised surveying occasionally, looked after the farm, and devoted every spare moment to study. He acted as assistant to Professor Porter during his course of lectures on chemistry at the University, and made, without assistance, all the preparations for the necessary experiments. He also turned his attention to the study of medicine while Dr. Nathan Smith was in Burlington, and was much with his son, Dr. N. R. Smith, who took up his residence there. He put together with copper wire a skeleton, in the office of the latter, and seems at this time to have seriously thought of medicine as a profession. If so, the idea was soon abandoned, and in the fall of 1822 he was in Keeseville, New York, assisting his father.

In January, 1823, when nearly twenty years old, he was offered an opportunity of spending some

time at Captain Partridge's military school at Norwich, Vermont, in company with the son of Colonel John Williams, of Salem, New York. He had been but three months in the academy when he accepted the position of Teacher of Arithmetic and Geometry. About this time, in company with Cadet Hill, of New Hampshire, he walked fifty-seven miles in one day, while on a scientific excursion; an instance of bodily vigor which proved him well fitted for the arduous duties of his after-life. He seems now to have made up his mind as to what his life-work should be, and from this time he devoted every faculty and every spare moment to the task of preparation. His standard of the qualifications necessary for a thoroughly competent civil engineer was very high, and he never set a lower mark for attainment throughout his life. No obstacle daunted him, no opportunity drew him aside. He writes of this time:

"When I joined the institution of Captain Partridge, it was with the view of qualifying myself for the profession of a civil engineer, and I steadily kept that object in view."

In the early spring of 1824 he went to Brattleboro', Vermont, with Mr. Joseph D. Allen, who afterwards became his brother-in-law, and whose name is well known in the profession in connection with many of the public works in New York and elsewhere, to take levels preliminary to the erection

of a proposed dam at that place. The river, however, "broke up" before their labors were completed, and it was with some difficulty and risk that they returned to Norwich. The ice-flood was one of the most destructive known on the Connecticut River. Almost all the bridges were carried away. That on which they crossed, which was in a dangerous condition when they passed, fell in and was swept away before they reached the top of the opposite bank.

This year he gave instructions in geometry and surveying, and completed a topographical survey of Norwich and its vicinity, covering an area of one hundred and fifty square miles, as practice-work for his class.

After accompanying the cadets on their march to Plattsburgh, of which trip he wrote the journal which was afterwards published, and almost immediately on his return to Norwich, he had an attack of inflammatory rheumatism, which became so severe that he was compelled to return to his home at Burlington, where he spent the remainder of the year, suffering intensely at times.

He was, however, even under these circumstances, far from idle. He devoted all the time he could to study, reading, and drawing, and to the preparation of a work on surveying. Some of his drawings of Vermont scenery were published, and

attracted so much attention that he received invitations from different parts of the State to use his pencil in the delineation of local natural beauties, with which he could not comply.

When Lafayette, the "hero of two continents," visited Burlington, in 1825, Mr. Johnson was requested to drill a company to act as escort to the general, which he did, and its members are said to have done credit to themselves and to their instructor upon that memorable occasion.

He took a deep interest in the political struggle between Adams and Jackson, which ended in the triumph of the former. He writes of this:

"The measures and principles advocated by the latter (Jackson) received my approbation. I differed, with pain, from my father, who was a supporter of Adams, but who was, notwithstanding, a Jeffersonian Democrat."

Thus, at the age of twenty-one, he avowed the political principles which, with slight modifications, he held through life.

During 1825 he gave much attention to practical mechanics. In company with two of his Norwich friends he spent some little time in making a mineralogical tour of Lake Champlain in a sail-boat, visiting all the points of interest, and making careful plans of the old works at Crown Point (Fort Frederick) and Fort Ticonderoga.

This year the institution of Captain Partridge was

removed from Norwich, Vermont, to Middletown, Connecticut, as a more central and suitable situation for such a school. This was brought about through the exertions and influence of Commodore McDonough and other prominent citizens of the latter place. Mr. Johnson was asked to take charge of the department of Practical Mathematics, which offer he accepted, leaving Burlington early in September by boat to Whitehall, thence by stage to Albany, and steamboat to New York. This was in the time of the *fast* boats Constitution and Constellation, running at the then unprecedented rate of *nine miles* per hour. From New York, then but little built above Canal Street, by boat to Middletown.

The year 1826 was spent in the discharge of his duties at the military academy, as Instructor in Civil Engineering, Mathematics, and Tactics. Every spare moment was given to qualifying himself for the profession he had chosen. He completed an accurate trigonometrical survey, embracing four hundred square miles, of Middletown and the vicinity, as he had done at Norwich, as an exercise in field-work for his pupils. Prominent elevations were determined trigonometrically, by barometric measurement and by level; roads, streams, town, city, and farm lines, by compass and chain. Of this the cadets in the Topographical Department, which he directed, made a large map under his supervision,

which still bears witness to the thoroughness of the work and the skill and patience of both instructor and pupils. This experience was of much use to him in his after-life. At this time he taught a new method of drawing maps, which was afterwards generally adopted.

In the fall of this year the cadets made a journey to Washington, of which the published journal was written by him.

In 1826 he found something else for hands never idle to do, in the construction of an orrery. Of this he writes:

"Mr. Newell, of Vermont, brought a small orrery to Middletown, and interested some Hartford and Middletown gentlemen to such an extent in it that a purse of seven hundred dollars was made up and put in my hands, and I was requested to superintend the construction of a larger one. On examining Mr. Newell's machine I found it defective in so many particulars, and himself so ill informed on the subject of astronomy, that I was obliged to begin, as it were, *de novo*, and make an entirely new and different machine. The one I constructed was six feet in diameter, placed on a pedestal. The armillary circles were of mahogany, faced with brass. The computations for the wheel-work to give the proper motions were made with much care. In addition to what Mr. Newell's machine contained, I gave to the earth its unequal motion in its orbit, devised a new mode of preserving parallelism to the earth's axis, exhibited the moon and its motions, and the inferior and superior planets, giving to each the proper inclination of their orbits to the ecliptic, and added the stars of the first magnitude. The latter were put on the spherical envelope of blue silk."

He also wrote a description of the orrery, called the "Newellian Sphere," which, to his great surprise, was published, without his knowledge, by one of the contributors, in *Silliman's American Journal of Arts and Sciences*. He received nothing for the time devoted to this work, nor did he expect to derive any benefit "beyond the knowledge of astronomy acquired, and the satisfaction of aiding in giving to the old man a means of support."*

In 1827 he was "Professor of Practical Mathematics and Civil Engineering," a department which he had himself founded, and the first of the kind in the country. The institution, called "The American Literary, Scientific, and Military Academy," at this time numbered three hundred and fifty cadets. His salary was six hundred dollars per annum,—a good one in those days for a young man of twenty-four. His board cost him two dollars and forty-two cents per week, and good hickory wood was five dollars per cord. Thus six hundred dollars then was practically equal to twelve hundred dollars now, if not more. He revised and published an arithmetic prepared by Mr. B. M. Tyler, of which he also wrote a review.

In the fall of this year he accompanied the cadets to Niagara Falls. Of this trip also he wrote an in-

* Mr. Newell exhibited the machine for this purpose.

teresting journal. The Erie Canal was then but recently completed, and he made a careful examination of the canal and the adjacent country in order to make himself master, not only theoretically but practically, of his future profession. On his return from this trip he designed an improvement in the manner of filling locks, by means of a cylinder having an opening throughout its entire length, to be placed across the lock underneath the upper gates. The discharge was regulated by revolving the cylinder. This plan he communicated to many practical engineers, and it met with general approval, but he made no attempt to introduce it in practice. At this time, in addition to his regular class in the academy, he had several young men studying with him, some of whom had acquired practical experience in canal and other work.

In February, 1828, he prepared and sent to his father drawings and estimate of a suspension railway on Palmer's plan, to be used between Port Kent, on Lake Champlain, and Keeseville, a distance of four or five miles. In this he suggested improvements on the original, one of which was the use of longitudinal bars on the sides of the suspension posts to prevent the lateral or rocking motion of the receptacles forming the car-bodies. The improvement contemplated the use of friction rollers on the receptacles to bear upon the longitudinal

pieces. This kind of railway, being not very expensive, and adapted to the use of animal power, he concluded would be serviceable in many localities.

The knowledge of the character and properties of railways was a subject to which he particularly called attention while in the academy in his instructions and lectures. In these he gave conclusive evidence of his belief in the future superiority of the railway over the canal, and he constantly advised his pupils to especially cultivate and increase their knowledge in respect to this. He writes:

"I had now (he was then in his twenty-fifth year) come to the conclusion that railways for the transportation of freight and passengers must ultimately take the lead of canals, notwithstanding the very recent successful accomplishment of the Erie Canal had created throughout the country an intense feeling in favor of that species of improvement."

In a letter to his father, of May 2, 1828, he directly asserts, and in a paper published a few months after, reiterates, his conviction of the superiority of the railway, and ventures the bold prediction that "when the railway was more thoroughly understood, the larger part of the inland business would be conducted upon them."*

* As illustrative of the feeling then existing in favor of the canal system, we quote the following from an address delivered before the Society of Civil Engineers, New York, May 1, 1872, by W. Milner Roberts, C.E., on the life and services of Edwin F. Johnson:

This statement, then considered, even by intelligent men, as at the best visionary, has been wonderfully confirmed by the experience of the past years, until now, looking back at it from the distance of half a century, it reads almost like a prophecy.

During this year he was elected a member of the College of Natural Philosophy of the University of Vermont, and it may perhaps be well to state here that during his lifetime he was the recipient of honorary degrees from several universities, and of membership in scientific and philosophic societies.

About this time Captain Partridge, of whom he speaks in the highest terms as a man of superior ability and large acquirements, one of the best lecturers on subjects with which he was acquainted

"In 1824 twenty-four gentlemen of the city of Philadelphia sent William Strickland, the distinguished architect, accompanied by his assistant, Samuel H. Kneass, to England and France, with instructions to investigate and report upon the subject of canals and railroads, in view of the determination of a number of the leading men of Pennsylvania to inaugurate a State system of public improvement, either by canals or railroads; the general impression being greatly in favor of a canal system, the railroad being at that time regarded as little more than an improved ordinary road. In the fall of 1825 the able report of Mr. Strickland was given to the public, and in that report he recommended the adoption of the railroad system. But the recommendation of Mr. Strickland fell upon unwilling ears, the Legislature of Pennsylvania having, a few months later, deliberately adopted the canal system in preference."

that he ever listened to, and possessing great industry and perseverance, received invitations both from New York and Baltimore to establish institutions on his plan, on a large scale and with complete endowments, in those cities.

Since his removal to Connecticut he had encountered great opposition, emanating from existing seminaries of learning in the State, and from that class throughout the country generally who have had the institutions of learning under their control, —the clergy.

Of the motives leading to the change in the management of the academy at this time Mr. Johnson thus writes :

"The growing popularity of the system pursued by Captain Partridge aroused their fears, and produced a determination apparently to bring the institution at Middletown, and the system itself, into disrepute. Their efforts had for some time been manifest, and to accomplish the object it had been called an 'Infidel institution,' and much was said of the mischief and danger to the country of cultivating a military spirit, etc. The institution, being a private one, managed and controlled entirely by Captain Partridge, it was desirable to put it on a more permanent footing. To this end application was made to the Legislature of Connecticut to give it a corporate character, with a board of trustees and collegiate powers. Two successive attempts to obtain these privileges, fully justified by the number of young men and the course and character of the instructions, failed. The young men of the institution were styled '*Janizaries*' in the halls of the Legislature, and could not have been

worse spoken of if they had attempted by fraud or violence to plunder the treasury of the State. All that could be obtained from the State for the benefit of the institution at Middletown was merely a few muskets for the use of the cadets, which were to be returned when called for, and bonds given accordingly.

"Under these circumstances, and urged by the inducements held out in other places, Captain Partridge determined to desist from any further effort on his part to continue the institution at this place, and in consequence a new arrangement was made."

It is difficult at this day to imagine such illiberality. The very record provokes laughter, mingled with regret, when we read the flights of rhetoric delivered before that august body, and learn that men of sound sense were actually swayed by them.

By the new arrangement Mr. Johnson and his friend, Mr. V. B. Horton, who was to be acting superintendent, took charge of the institution. Mr. Johnson, however, had no intention of making teaching a profession, but still held firmly to his purpose of fitting himself for the work of a civil engineer. The new arrangement was entered into as a temporary measure.

The same difficulties and the same narrow-minded opposition—an opposition, it may be said, in slight apology for its authors, not so much of principle and conviction as of self-interest—hampered the management of the institution under the new régime as under the old. Mr. Johnson and Mr. Horton, after a fruitless struggle, were obliged to

discontinue the institution in 1829. During this time Mr. Johnson used his pen to advantage, contributing papers on scientific and literary subjects to reviews and periodicals in Connecticut and elsewhere.

At the age of twenty-six, Mr. Johnson turned to the active practice of his profession, "for which," as he himself writes in a private letter, "I believed I had qualified myself in a superior manner."

We have given at greater length than was at first intended the history of his earlier years. It has been done to show the high standard he set for himself, and the training, physical and mental, which to him seemed necessary to enable him to *enter* the profession he had adopted. This training, with a sound body, well-balanced mind, and singularly clear judgment; with habits of industry, application, and perseverance; of self-denial and economy; and an honesty that by some might be termed Quixotic, formed the only capital with which he began his professional career.

PART II.

1829 to 1846.

Mr. Allen, who was at this time engaged on the Cumberland and Oxford Canal, directed his attention to the proposed survey of the land lines of the Erie and Champlain Canals; and, through him, he made an arrangement with Mr. Holmes Hutchinson, of Utica, New York, who had received the contract for the survey from the State, to execute a portion of the work for him.

He went to Utica, where he made arrangements for commencing the survey, the object of which was to establish definitely and put upon record the outlines of the ground occupied by the canals, which had not before been done. His part of the work included that portion of the Erie Canal from Canastota to Albany and the whole of the Champlain Canal. Some differences of opinion existed as to the plan of the survey, and that proposed by him was finally adopted by the canal board.

In April of this year he was offered the position of professor in the North Carolina Institute.

He published at this time, among other papers, a review of Mr. W. C. Redfield's pamphlet on a proposed railway from the Hudson to the Mississippi, in which he directed attention to the route to be

followed in detail, and named Rock Island as the Mississippi terminus. He gave also in the same paper eighteen reasons for his conviction as to the superiority of the railroad over the canal system.*

* Mr. Johnson had three years previous conceived the possibility of connecting the waters of the Hudson and the Mississippi by rail, and had often noticed it in his lectures and made it the subject of conversation. Of Mr. Redfield, with whom his relations were always friendly, and who was the author of the pamphlet which called forth the review, he writes, "Mr. Redfield, I found, was a native of and had been not long previous a resident of Middletown, and a saddler by trade. He went to New York under the patronage of Richard Hubbard, of Middletown, who was then largely interested in steamboats, as an agent for the steamboat company, was frequently in Middletown while the academy was in operation, and, having much to do with steam, I have thought it not unjust to suppose that he acquired many, if not all, of the views advanced by him in respect to railways from his intercourse with those who were connected with the academy. There had been from the first many young men from Middletown under my instruction for the purpose of qualifying themselves as engineers, and in my instructions to them, and in my lectures, I had, during the whole time I was connected with the academy, advanced the same opinions in relation to railways as were expressed in my review of Mr. Redfield's pamphlet. In thus speaking of Mr. Redfield I do not wish to charge him with designing to do anything improper, but inasmuch as he could not probably have been led by education to entertain the views which he advanced on the subject of railways, he must have imbibed knowledge in some other way, and then was there any so probable as that to which I have alluded?"

This review called forth a great deal of attention and of favorable comment, although for some time the credit of its authorship was given to one who certainly seems least to have deserved it.

On this subject, of which much has been said and written, I give his own words. It will be remembered how early (since 1825) he had given his attention to railways, and how he had made them a specialty, so to speak, in his instructions and lectures.

"I had urged upon those under my charge the importance of particular attention to that branch of the subject which related to the construction and operation of railways, and I did this from a conviction that railways would, in a few years, become the principal mode of intercommunication throughout the country. In accordance with these views I took the opportunity, when penning a review of a project for a proposed railway from the Hudson to the Mississippi, to make a comparison between railways and canals, in which I stated my conviction that railways would be preferred to canals in most situations. This review was penned in the month of April, and in May was sent to the Messrs. Carvill, of New York, the publishers of the pamphlet containing the project referred to, the author being then unknown to me.

"In the fall of the year, six months *after* my review was sent to New York, the first successful experiment in the application of locomotive power to railways was made in England on the railroad then recently built between Liverpool and Manchester.

"Soon after the publication of these experiments a communication appeared in the *Journal of Commerce*, New York, over the signature of De Witt Clinton, civil engineer, relative to the

proposed railway from the Hudson to the Mississippi, in which a large portion of my review was copied *verbatim* without giving me credit. On perceiving this I wrote to the Messrs. Carvill for an explanation. They informed me in reply that my paper was handed by them to Mr. Redfield, of New York City, the author of the pamphlet. Mr. Redfield subsequently acknowledged receiving the review, and said he had 'handed it with other papers to Clinton for his opinion on the project,' and was as much surprised as myself to find my sentiments and language embodied in Mr. Clinton's letter without any credit being given. I requested, under the circumstances, a return of my paper. He applied to Mr. Clinton for it, but never obtained it. *It had been mislaid and could not be found.* Fortunately I had retained a copy, and had, before sending the original to New York, submitted it to several of my friends in Middletown,—Mr. Horton, Dr. Barratt, Mr. Webb, and the Hon. Samuel D. Hubbard. It was in the office of the latter gentleman that the review was penned.

"I took no further notice of this disgraceful plagiarism* of Clinton at that time, Mr. Redfield promising to have my entire review published in the New York papers at the first convenient opportunity."

In 1830 this review was published in the *New York Statesman*, a paper edited by John M. Mumford. It was republished in 1831, in pamphlet form, and distributed gratuitously by Mr. Johnson in the towns and villages along the entire route to the

* This plagiarism was noticed in several papers, but no reply was elicited. Friends of Mr. Johnson also wrote to Mr. Clinton in reference to the matter, but no response was made, and no notice taken of their letters.

Mississippi; and this may be called the inception of the New York and Erie, now the Erie Railway, of which he became chief engineer in 1836. It was one of the greatest works of Mr. Johnson's life, and the preparatory step to his grand scheme for connecting the waters of the two oceans,—Atlantic and Pacific.

On the 11th of February, 1830, he wrote to H. J. Ranney and J. H. Vance, former pupils of his, and at the time employed on the Baltimore and Ohio Railroad, that he had been "convinced from the first that railways must ultimately take the lead of canals," and that "the improvements making in the application of steam as a propelling power for carriages on railways will produce a change in public opinion in regard to the superiority of railways over any other known mode of effecting an overland communication."

In the review above mentioned he committed himself and his professional reputation to this conviction in the following remarkable words, remarkable when the time, the dominancy of the canal interest, and the decided bias of popular and professional opinion are considered. For at this time even the ablest engineers were either very doubtful of the future of the railway system, or else "damned with faint praise," as did the late Judge Wright, the eminent canal engineer, who, writing to the Presi-

dent of the Chesapeake and Ohio Canal, placed the railway in a middle position as a means of transportation "*between a good turnpike and a canal.*"

On page 9 of that review Mr. Johnson uses these words:

"*Railways as a means of intercommunication possess properties which in most situations will render them superior to canals; and with reference to the United States, considering how diversified is the surface by hills and valleys, railways, when properly constructed, will be found the most valuable and effective;* AND ULTIMATELY, WHEN THEIR MERITS BECOME BETTER KNOWN AND MORE FULLY APPRECIATED, BY FAR THE GREATER PORTION OF THE INLAND TRAVEL WILL BE CONDUCTED UPON THEM."

In 1869, forty years after these words were written, the Union and Central Pacific Railways were in full operation, the iron band across the continent was complete, a net-work of railways covered the ground between the Hudson and the Mississippi, and the *canal* had taken its true position "as a means of transportation" between a good turnpike and a railway.

But what a marvellous forty years that has been of enterprise and development! The convictions that appeared then to the uninformed and prejudiced, chimerical, have been proved true and reasonable.

Looking back upon those forty years, are there any who are disposed to wonder or to laugh at

what seems to us the short-sightedness and ignorance of that day? We had best not congratulate ourselves until we are proved. In every age and in every country the ignorant and the interested have been found ready to despise and to crucify great thoughts and great thinkers. Are we of this nineteenth century exempt from this error? Let us be careful how we call our brother visionary, lest after-time, with retributive justice, should wonder at our blindness. It is always easy to be a prophet after the fact.

An eminent civil engineer writes of Mr. Johnson at this time:

"Strange as it may seem to many, Mr. Johnson, as far back as 1829, in the very infancy of railroads in the world, published a paper on the subject which proved him to have been at that period, at the early age of twenty-six, among the foremost men in the United States in appreciating the wonderful future of the railroad system; at a time, too, when the then powerful canal influence was freely used in combating the progress of the infant railroad. His arguments were of the most practical character. . . . His mind had already comprehended and grasped the coming future, even before the opening of the Liverpool and Manchester line, which occurred in 1830."

In 1830, Mr. Johnson wrote a review of Colonel Long's Manual, pointing out some important defects. This criticism was published in the *New England Review*.

On the opening of navigation he resumed and

completed his work in the survey of the land lines of the Erie and the Champlain Canals, on the plan proposed by him and adopted by the canal board.

The academic buildings in Middletown having been ceded to other parties, were converted to the use of a Methodist university. He was induced to accept the position of Professor of Natural Philosophy and Civil Engineering, at a salary of one thousand dollars per annum. Private reasons, and the request of several of his Middletown friends, induced him to make this arrangement with the university, against the wishes and advice of those interested in his professional career. He thus became one of the first instructors in the now flourishing "Wesleyan University."

He was married September 7, 1830, to Miss Charlotte Shaler, daughter of Nathaniel Shaler, merchant.

During the fall of this year he was employed in superintending the execution of the maps of the canal surveys, and had arranged with Mr. Hutchinson to do this in Middletown.

His engagement with the Wesleyan University was simply a conditional one, and he never allowed it to interfere with the course he had laid out for his life-work, and for which he was by nature and education so thoroughly qualified. Whether he ever engaged actively in the duties of his professorship

is questionable. There is no data as to the character or duration of his connection with the faculty, and at best it must have been very brief, for in May, 1831, we find him engaged in locating a small branch railway, connecting the Morris Canal with some factories at Paterson, New Jersey; and by the end of this month he was actively employed as assistant to Major Beach, in the survey of the Catskill and Canajoharie Railway, which was begun at Canajoharie May 20.

At this time, also, two surveys were made under his direction from Schoharie village towards the Susquehanna, and across the summit to Sharon. In August he returned with Major Beach to Newark, New Jersey, where the maps, plans, and estimates of the summer work were completed.

During the year he received from Judge Wright, whose son had been one of his pupils, the offer of a position on a Southern work at a salary of two thousand dollars and expenses, which he declined.

Though young, he was now in communication with several prominent men, had a large circle of friends among the foremost citizens of New York and elsewhere, and was becoming widely and favorably known in his profession.

After passing a short time at home, he resumed his duties in October on the Catskill and Canajo-

harie Railroad, and was engaged in making arrangements for the letting of the work.

Ground was broken at Catskill on the 27th of October, 1831, and he became Resident Engineer of the Middle and Western Divisions. It was then hoped that the entire line would be under contract by the end of the year. In December he returned to Middletown, and in the winter of 1831–32 he wrote his paper on the Epicycloid, which was published in the *American Journal of Arts and Sciences*, as well as several shorter papers. His pen was rarely idle. He had during several previous years employed a portion of his leisure in the preparation of a work on surveying, which his friends urged him to publish. It was his intention to do so as soon as he had the necessary time for revision and correction. That time never came. The active duties of his profession crowded upon him, and in his later life, when perhaps, if ever, he might have undertaken it, the subject had so developed that his work would have been not revision merely, but, to a great extent, rewriting. Able works on the same subject had appeared, and other and more important subjects occupied his mind and pen.

We cannot, however, but regret that a work so clear and practical, dealing with the details and emergencies of field-work, should not be within reach of all.

During his stage-journeys at this time between Hartford and other places he examined the country, and published a plan of route and estimates of a railway from Hartford to Guilford, Connecticut.

He writes from Albany at this time, that the charter for the New York and Albany Railroad "will probably be granted this year, but the prospects of the Great Western (New York and Erie) are more doubtful."

Even at this date, letters in his private correspondence from noted engineers show that the profession were by no means unanimous in their estimate of the future of the railway system, some not hesitating to express the decided conviction that the railway would never equal the canal in importance.

Work seems at this time to have been suspended on the Catskill and Canajoharie Railroad, Major Beach writing in August, 1832, that he "thinks it will be soon resumed." This year Mr. Johnson sent to the government at Washington plans and specifications for the Potomac Bridge. The Secretary of the Treasury wrote October 15 for an estimate of cost, which Mr. Johnson forwarded on the 18th, but heard nothing further in regard to the matter. A long letter to his father at this time expressed his views on civil government, and the duties and responsibilities of the citizen, afterwards

elaborated in his published work entitled "Words for the People." During the winter he completed the maps of the canal surveys. In February, 1833, he writes from Albany again:

"My plans for the coming season are not definitely settled; the projects for railroads are innumerable; some of them are set afloat by brokers and speculators for the purpose of playing upon the stock. Many of them will fall through, but the business of engineering will be good for some time to come."

He also wrote a paper upon the subject of the Water Supply of the city of New York. In this he took a great interest, and the plan proposed by him and submitted to many leading men was sufficiently daring and characteristic, so much so as to appear visionary* to all but a few kindred spirits at that time. His time was now much employed in local work, and in preparing plans, specifications, and estimates for various buildings.

April 15, 1833, Mr. Johnson was appointed assistant on the Chenango Canal, of which Mr. J. B. Jervis had charge, refusing the solicitation of his Middletown friends to accept political position, as a year before he had refused the offer of the situation

* At the present day, and in the present advanced stage of engineering knowledge and experience, this project has lost its seemingly visionary character, and it is possible that it might even be adopted with advantage. It will appear with other unpublished works of Mr. Johnson hereafter.

of cashier of the Middlesex County Bank of that place.

He began work on the canal April 20, having his headquarters at Clinton. Among his assistants on this work were Mr. Levi Williams, Mr. Oliver H. Lee, and Mr. William J. McAlpine. He remained in this position until September, 1833, his family spending the summer with him.

In September he closed his engagement as assistant on the canal, and on the 28th of that month received an appointment from William C. Young as Resident Engineer on the Utica and Schenectady Railway. He was offered his choice of divisions and selected the Western* (Utica to Little Falls), for the reason, as stated in his letters, that "he felt confident that at some day not far distant the railway would be continued west." In this position he remained through the year, returning to Middletown during the winter of 1833–34, where his private affairs and duties demanded close attention. In the spring of 1834 he removed his family to Utica, where he took up his residence. He remained with the Utica and Schenectady Railway until 1835.

In the month of January, 1835, he was offered the position of Chief Engineer of the Auburn and Syracuse Railway. This year was a busy one even for

* Charles B. Stuart, C.E., had charge of the Eastern Division of the road.

him. The New York and Erie Railway had applied to the State for aid. The Legislature directed the Canal Commissioners to report upon the relative merits of railways and canals. The board intrusted the duty to John B. Jervis, Holmes Hutchinson, and Frederick C. Mills, only one of whom had any experience upon railways. The report thus made was decidedly unfavorable to the railway, and this in the face of the clearest evidence. This report was quite severely criticised by Mr. Johnson in the *Railroad Journal*, and its manifest errors and inconsistencies exposed in a series of articles, which provoked reply, the latter doing him no harm, while the former did him much good. This report and the articles of its supporters are sufficiently curious at this day, when no question exists as to the superiority of the railway system, and probably Mr. John B. Jervis would be willing now to acknowledge his defeat, if not by force of argument, at least by force of circumstances.

He introduced and published at this time a plan of estimating work in grading by quantities and haulage, since very generally adopted.

He wrote several articles this year on the subject of the Hartford and New Haven Railroad, suggesting three routes for that object. Also several papers, as well as a report, with maps, plans, and estimates, upon the proposed Ontario and Hudson

Ship Canal. Some preliminary surveys had been made a year or two previous for this work under his direction. Of this project a friend of Mr. Johnson writes as follows:

"As early as 1834 the necessity for some additional provision for the trade between the seaboard and the great lakes became apparent, and the subject of the enlargement of the Erie Canal, which was built ten years previous, began to be discussed. The great length of this canal,—three hundred and sixty miles,—the probability of the serious interruption of its navigation, together with the expense of this enlargement, suggested the building of a ship canal, requiring but one hundred and fifty miles of new work, between Lake Ontario at Oswego and the Hudson River at Albany. Mr. Johnson with others strongly advocated the latter project as providing a superior channel of communication, the saving of time and cost of transportation, and in the beginning of the following year he made an able report upon the subject, in which he incorporated the survey which he had previously made of the larger portion of the route. The general agitation of this project provoked the opposing efforts of that portion of the State of New York which lay west of the computed lines, and resulted eventually in the success of the old work. Time and circumstances have seemed to strengthen the arguments then presented by Mr. Johnson in his repeated papers upon the subject, based as they were upon a broad and liberal comprehension of the rapidly-increasing demands of what was then the 'Far West,' but now is but the centre of the settled portion of the country."

This was Mr. Johnson's last connection with canals, except in his constant advocacy of the proposed ship canal across the Isthmus of Darien, and the ship canal and marine railway around Niagara

Falls, in which, to the close of his life, he took a great interest. From this time he devoted himself almost exclusively to the construction of railways and the development of the railway system of the country. Throughout his life he was in receipt of applications for his services in various parts of the country, and upon important works. He once said to the writer of this that, except in one or two instances at a very early period of his career, he had never to seek work, but was sought by it.

October 10th of this year (1835) he attended the laying of the corner-stone of the Auburn Canal Dam, of which he was the "principal engineer;" the event being celebrated by the presence of many prominent men, and by a "dinner and ball."

In December of this year occurred the great fire in New York. In February (27th), 1836, Mr. Johnson wrote to Mr. Devereux that he could arrange to leave the Auburn and Syracuse Road, retaining, however, the supervision of that work, and take the position offered by the New York and Erie Railroad Company.

The enlargement of the Erie Canal led to some correspondence on the necessary width of locks, the canal board ultimately adopting Mr. Johnson's views. On the 1st of May the New York and Albany Railroad Bill passed both houses of the State Legislature.

In the spring of 1836, Mr. Johnson and Mr. Talcott were appointed Associate Engineers on the New York and Erie Railroad, with Judge Benjamin Wright as Consulting Engineer, the duties of the latter being simply advisory. Mr. Johnson had the control of the work from the Hudson River to a point called Painted Post, a distance of three hundred miles, Mr. Talcott having charge of the portion from Painted Post to Dunkirk. His salary at this time was five thousand dollars per annum and expenses. He now moved to Newburgh, New York, with his family.

In March, 1837, Judge Wright withdrew from the service of the company, and Mr. Johnson became Chief Engineer. He was then, and continued throughout his professional career to be, an advocate of the broad gauge, so called,—not the "broad gauge" as now distinguished from the "narrow gauge," but of the six-foot gauge as distinguished from the four-foot eight and one-half inches. Through his influence the former (six-foot) was adopted for the New York and Erie. It is well to remember that at this time there were but sixteen miles of the narrow (4′ 8½″) gauge constructed in the country. Even as late as 1872 he published an article in *Van Nostrand's Magazine* strongly supporting the broad gauge for all trunk-lines at least.

In 1837, when the affairs of the New York and Erie Railroad Company were getting into a more settled condition, and the path was becoming plain for the company to pursue, the great revulsion which shook to its foundations the whole financial system of the country occurred, and the New York and Erie Company were obliged to suspend operations in all cases except where work was under contract. Mr. Johnson still remained connected with the Auburn and Syracuse Railway, and about four months were required for the completion of that work. October 27, 1837, he writes, that "owing to the pressure of the times the Auburn and Syracuse Company have dispensed with the iron plates; maple ribbon-pieces spiked upon the rail timber are to be used as substitutes." This, he thinks, "will answer the purpose so long as horse-power is used."

In the fall of 1837 he was in New Haven, though still connected with the New York and Erie Railroad, on which, however, all work had ceased. The country was slowly recovering from the general depression, and it was expected that work would be resumed on that road in the spring of 1838.

In January, 1838, he made a report in relation to the New York and Erie Road, in which he showed the efficiency of steam locomotive power on high gradients, which was adopted by the Railway Committee of the Legislature of New York, and em-

bodied in their report. The conclusions arrived at were different from those entertained by the profession generally, as there existed a strong prejudice in favor of low gradients, no matter at what cost obtained. This was afterwards republished in the *Railroad Journal.*

On the 17th of May, 1838, he received the appointment of Chief Engineer of the Ogdensburgh and Champlain Railroad from Governor Marcy, in which work he was engaged the remainder of the season, the office-work occupying his time until February, 1839. In October, 1838, he wrote to his father:

"I sent you a paper from Albany containing a notice of my appointment as Chief Engineer of the New York and Albany Railroad. The New York and Erie Company are determined to remain in *statu quo* till spring. I have in the interim, by the advice and consent of the leading men in that concern, accepted conditionally the appointment on the New York and Albany Railroad."

In the early part of 1839 he exhibited at the Fair of the American Institute a model of a screw power-press, and also of a six-wheeled car, in which the weight of the car was equally distributed, and the centre wheels had a movement transverse to the line of road to enable them to conform to the curves in the road. This was intended for short cars of from seventeen to twenty feet long. For long cars he proposed two trucks of six wheels each, arranged on a similar plan. He published at this time a cir-

cular recommending the removal of the American Institute to New York City. This he had signed by many members of the profession, printed in the *Railroad Journal*, and laid before the convention, the result being the defeat of the Philadelphia movement.

April 19, 1839, he was offered the management of the Stevens Joint-Stock Association of Hoboken. The property of the Stevens' and their associates, including the steamboats, landed estate, and railway in New Jersey, etc., was undivided, and so situated as to make a division impracticable. They therefore obtained a charter, and proposed putting the whole of the property in as capital stock.

Mr. Johnson was offered the position of President of the Association, with a salary of five thousand dollars per annum, but hesitated because he feared losing ground in his profession. He, however, finally accepted the offer, and entered upon his duties July 17, 1839, still remaining connected with the New York and Albany Railroad, and residing in Hoboken. He retained this position until June 7, 1840, when he resigned, the deranged financial condition of the country preventing the prosecution of operations. At this time he strongly advocated the establishment of an Institute of Civil Engineering in the city of New York.

In the summer of 1840, the prospects of the New York and Albany Road reviving, he located the line through Westchester County, and was also called

upon to examine into the condition of the Catskill and Canajoharie Railroad Company.

During this and the preceding year he wrote and published many papers on various subjects, and among them a valuable little treatise on railway curves, with tables of quantities.

The spring of 1841 found him busily engaged in endeavoring to start work on the New York and Albany Railroad. That road experienced many difficulties, and but little was done upon it during this year.

He was also engaged to plan and superintend the construction of a bridge over the Passaic River at Belleville. He had now taken up his residence in Middletown, Connecticut, and had accepted the position of Consulting Engineer on the Springfield and Hartford Railroad. Some time during the year was spent in the examination of the affairs of the Catskill and Canajoharie Company, and in work in Westchester County, New York. His plan of State aid to railways was published, and a paper upon "Width of Track." He was also engaged upon a model for a new sawing-machine movement which he had invented, and his private affairs kept him very busy during all his spare hours.

In January, 1842, his friends in Albany desired to propose his name for the position of Canal Commissioner, but he declined the nomination. The early

part of the year was spent between New York and Albany, looking after the interests of the New York and Albany Road, and of the Catskill and Canajoharie. He was still busy in superintending the construction of his model for the new sawing-machine movement, and also engaged upon a model for an eight-wheeled locomotive.

During February he accepted a position as Director of the Shaler and Hall (now Middlesex) Quarry Company, of Portland, Connecticut, and was offered, but declined, the Chief Engineership of the Western Division of the Erie Canal. On the 30th of March the new sawing-machine was in operation. April 26th he was reappointed Chief Engineer of the New York and Albany Railroad, and on the 30th of the same month he suffered a severe loss in the death of his father, John Johnson, at the age of seventy-one. To him he had through life been tenderly attached. Their relations had been of the most intimate and affectionate kind, and as he had grown older the tie between them seemed to become more like that between two loving brothers, while never losing its more sacred character. They were in constant correspondence, and his letters to his father are among the most beautiful of the written words he has left. No better monument could be his than the publication of these letters and those of the father to the son.

In the early part of 1843, Mr. Johnson was consulted as to the possibility of his again taking the position of Chief Engineer of the New York and Erie Railroad by those then interested in the concern. He remained, however, the whole of this year in the service of the New York and Albany Company. He opened a private office at this time at No. 98 Merchants' Exchange, New York, with W. R. Casey, C.E., and much of his leisure-time was employed in writing for the *Railroad Journal.*

In March, 1844, he was nominated to the Connecticut Legislature, but declined the honor. He still continued his connection with the New York and Albany Railroad, but little was done by that company during this year. He wrote an article on the Post-Office Bill presented by Mr. Merrick, which attracted much attention, and was also engaged in drawing up plans and specifications for various works. A patent was issued to him about this time for an improvement in locomotives.

In 1845 he engaged with his brother-in-law, Mr. Allen, as a silent partner in a warp-factory in Vermont. Later in the year he made an examination of the route of the Whitehall Railroad, and at its close was actively engaged in the survey and advocacy of the New York and Boston Air-Line Railroad, with which he was connected through 1846.

PART III.

1846 to 1872.

He resigned his position as Chief Engineer of the New York and Albany Railroad in the month of March, 1846. and that spring he was again nominated and again declined to serve in the Legislature of the State. During this year he was engaged in what was known as the Bear Mountain project, and in the examination of coal lands in Pennsylvania, in which he was interested. He was elected a director in the Middlesex County Bank, but declined the position of president of the same institution.

In July he took charge of the Syracuse and Oswego Railroad, which occupied the remainder of the season and the ensuing winter.

In 1847 he was working and writing for the New York and Boston Railroad, commonly called the Air-Line. His private affairs and interests were varied, and required much of his time and labor during the year.

In January, 1848, the Air-Line Railroad Company was organized, and he accepted the position of Chief Engineer. During the year he wrote a communication for Augustus James, Esq., upon the subject of the Hudson River Railroad.

His mind had already grasped the thought of the possible Pacific Railroad, and from this time he gave much of his study and work to the extension of the railroad system west of Chicago, while still actively interested in many Eastern enterprises.

In March of 1849 he began the survey of the branch from Middletown to Berlin, for the Hartford and New Haven Railroad Company, which occupied him until June.

His continued advocacy of the Air-Line Road, however, provoked the narrow-minded spite of the managers of the road (the Hartford and New Haven). Although there was no possibility that the local business of the Hartford Road would be in the slightest degree endangered, or that even the bulk of the through travel would be seriously affected by the construction of a competing road, yet for years a persistent and unscrupulous war was carried on against the Air-Line Road, both in and out of the Legislature of the State of Connecticut, by that corporation. At this time not only was a new party put into the field without the knowledge of, or any notice to, Mr. Johnson, but by false representations the maps and profiles of his survey were obtained from his office by parties employed for the purpose.

While it is not difficult to understand how minds of a certain calibre could resort to such means, un-

necessary and childish as they were, it is yet a matter of regret that men could be found, even claiming to belong to the profession, who could lend or sell themselves to the execution of their purposes.

In the fall of this year Mr. Johnson was engaged by the Rutland and Burlington Road in the matter of an application to the Legislature of Vermont, and spent several weeks in Montpelier. He also examined the ground and prepared and published plans and estimates for the Vermont and Canada Railroad, and the St. Lawrence and Champlain Canal, and in November was elected a member of the New York and Boston Railroad Board.

In April, 1850, he was offered but declined the position of Chief Engineer of the Albany Water-Works, and this year, also, he suggested the necessity for the construction of works for supplying his native city with water. He made plans and estimates, and interested himself in the effort to procure a charter for that object.

During July of this year he was engaged in an examination of the ground and of the bridge at Wheeling, Virginia, at which time he first met Mr. E. M. Stanton, then a law-partner of Judge Shaler, of Pittsburg, and afterwards Secretary of War in the Cabinet of President Lincoln, with whom he continued on intimate terms through life. Mr. Johnson

had been requested by Chancellor Walworth, commissioner, to make a professional examination of the ground, and to report his opinion to him. The case, which excited much public interest at the time, was argued before the Supreme Court. Much of his time was occupied in the necessary examinations, but he was not called upon to testify, as his connection with Judge Shaler was urged as a reason for objection, and the objection sustained.

In September of this year he was offered, through the Hon. Robert J. Walker, the position of Chief Engineer of a railway in Wisconsin, which he accepted, and in the later fall he was in that State, actively engaged in organizing the survey of the Rock River Valley Union Railroad, and was occupied in this service the remainder of the season.

The winter of 1850–51 he spent in Middletown, returning to the West in June, where he remained until August, when his interests at the East called him to New York. He was in Wisconsin again in September, and the remainder of this year and the whole of 1852 was devoted to the prosecution of the work on the Rock River Valley Union and Illinois and Wisconsin Railways. The principal part of his time was spent in Chicago. His friend, the late William B. Ogden, was then, as ever, actively interested in all the enterprises bearing upon the welfare of Chicago and the West, and was prominently

identified with all the public works in which Mr. Johnson was engaged, until the death of the latter. Mr. Ogden and Mr. Johnson, with the Hon. Robert J. Walker and others, during the next year organized the Chicago Land Company.

He was busy at this time during his leisure hours in writing his exhaustive preliminary report upon a Pacific Railway. This work, which he justly regarded as the crowning one of his life, professionally, was a wonderful example of foresight, skill, labor, and faith; for it must be remembered that in 1851–52 the project of railway connection between the great lakes and the Pacific was almost as startling and, to many, seemed quite as visionary as did, in 1829, the proposed Great Western Railway, from the Hudson to the Mississippi. The survey, or, rather, reconnoissance of General Isaac Stevens, was not made until 1854, and his report, when published, seemed but a confirmation of what Mr. Johnson had written, and the actual barometrical measurements and description of the ground traversed did not materially differ from the estimates upon Mr. Johnson's profiles and the maps he had published, based as these latter were upon a mass of reading and a rare experience, aided by a peculiarly clear judgment.

In November, 1853, he was requested to take charge of a projected railroad from Newburgh to

Syracuse, in the State of New York, but his Western engagements occupied his time fully. He wrote his reply to Mr. Brodhead at this time, entitled "Gauge of Railroads," and was engaged during the year as consulting or advisory engineer on several important works.

In 1854 he was still connected with the Western roads. This year his work was published entitled "Railroad to the Pacific, Northern Route, its General Character, Relative Merits," etc., with maps and profiles. Of this work an eminent civil engineer writes:

"Mr. Johnson in 1853 prepared a paper on the subject of a route to the Pacific, in which he advocated the present general route of the Northern Pacific Railroad with signal ability, showing that he had entered into the most critical study of the conformation of the extensive regions traversed by him with the mind's eye of a sound engineer."

The same writer continues thus:

"The peculiar forte of Mr. Johnson lay in perceiving clearly and adapting readily all practical thoughts, introducing them by charming chains of reasoning into his carefully-elaborated reports, which are, indeed, masterpieces and models of their kind."

He always acknowledged himself greatly indebted to Lewis and Clark for the accuracy and comprehensiveness of their report of the Expedition of 1805–6 in the preparation of this work.

In March of this year he was consulted in regard

to the feasibility of railway connection between Oswego and Troy by a new route, and later was interested with Judge Jessup and others in the Lackawanna Association, and superintended the necessary surveys. He published, about this time, in the *Railroad Journal*, a paper on the early history of the New York and Erie Railroad.

In 1855 and 1856 he was much engaged in private business and in furthering the Northern Pacific Railroad project. He was offered the office of mayor of his adopted city, Middletown, Connecticut, in January, 1856; a position which he wished to decline, but which, through the solicitation of friends, he was induced to accept, and which he held for the next two years. During his term of office he caused an accurate survey of the entire city to be made, adjusting curb-lines, and planned and strongly recommended the adoption of a thorough system of sewerage. He compiled a new city charter and by-laws, at much expense of time and labor, which were accepted by the city and confirmed by the Legislature. He urged upon the citizens the construction of works to supply the city with water, and was as active and conscientious in his public duties as in all other relations of life.

On the 21st of March of the same year (1856) he was nominated and elected to the State Senate. He accepted this nomination upon the express con-

dition that he was not to be called upon to undertake any of the usual political work, refusing to act as chairman of political meetings, or in any way to advance his own interest or to influence his fellow-citizens. His election under these circumstances, by an unusually large majority,—many of the opposing party voting for him,—was a gratifying tribute to him, and a mark of the esteem and confidence in which he was held.

His city and senatorial district both largely profited by his wisdom, foresight, and industry. Among other papers written at this time was a valuable communication in regard to the bridge over the Hudson River at Albany.

In 1857 his private business demanded his close attention. The second great financial crisis which had occurred during the time of his active professional life had depressed the country and paralyzed for the time all its enterprise and checked its course of prosperity. He was himself a heavy sufferer, and much of the savings of twenty-seven years of unremitting toil was swept away, and his resources crippled by the depreciation of real estate and other property. He was in Chicago during the year, where the state of business affairs demanded his close personal attention. He wrote several papers at this time on the subject of the resumption of specie payments.

In 1858 he accepted the office of President and Treasurer of the Shaler and Hall Quarry Company, in which he was interested, and his wisdom and experience carried the company safely through those troublous days and the depression of the first years of the great war. He was elected a member of the Board of Education of Middletown, Connecticut,—a subject in which he always took a deep and earnest interest,—and while thus a member drew up a code of rules and regulations for the public schools, which were adopted.

During 1859* his time was fully occupied in the

* In Mr. Johnson's journal for 1859 occurs the following memorandum, which may be of interest:

"Tuesday, July 5. Met J. P. Mumford and Captain Wiswall (in New York). Mr. Mumford states that he went to Washington in April, 1812,—then twenty-one years old,—to get copies of Fulton's patent for steamboat. That T——, the superintendent, threw obstacles in his way; that he went to the Secretary of State, Mr. Monroe, to whom he presented letters. Mr. Monroe said that Mr. Mumford asked no more than was lawful and reasonable. Still he had trouble, and went to Pinckney, the Attorney-General. The patent papers of Fulton were locked up in a separate mahogany case, and Mr. T—— had the key. A letter of four pages came from Fulton remonstrating against copies being taken, but Mr. Mumford copied the papers and caused them to be transmitted to Mr. Higginson, an American merchant in London, England, whose object was to introduce steam-navigation into that country, Mr. Mumford having been employed by Higginson to procure the papers. Since the de-

various interests committed to his charge. During the next year (1860) he took an active interest in the political campaign, being a strong supporter of the late Hon. Stephen A. Douglas, writing several articles on the questions of the day, and a series of leaders for the Douglas organ of his city.

Towards the close of the year the country began to be seriously disturbed by the impending troubles at the South, and business of all kinds was much affected. This added much to his anxiety and labor, for the management of a business such as that with which he was most actively connected, the outstanding claims of which were large and not easily collectable in bad times, was a delicate matter. He proved himself in this, as in all else, fully equal to the trust reposed in him ; but this year and the next were anxious and toilful years to him.

July 2, 1862, Mr. Johnson was called to Washington to consult with Secretary Stanton on various

struction of the Patent Office by fire, when the Fulton papers were destroyed, Mr. Mumford has applied to one of the Higginson family in this country to procure the papers sent abroad, that he might give them to the Patent Office, but they have not yet been found.

"Mr. Mumford distinctly recollects (and his memory is remarkable) that Fulton did not claim any improvement on the steam-engine of Watts, only the application of it to propel a boat four miles per hour."

Mr. Mumford was then sixty-eight years old.

points connected with the prosecution of the war. He was offered at this time the rank of brigadier-general and a command in the Southwest, which he declined.

Mr. Stanton then wrote that he would gladly have him in Washington, and asked if he would take the position of Assistant Secretary of War in case Mr. Tucker declined, and said that if in any way he could meet his wishes he would gladly do so. Mr. Johnson, however, did not feel that the attention necessary to the right management of the interests confided to him or the care demanded by his private affairs would permit him to accept any public trust.

He was requested to put his opinion as to a general plan of operations, and in regard to the North-eastern coast-defences, into writing and to send it to the War Office. This he did, and his paper on the Maine defences was completed April 4, 1863.

Throughout all these later years, when not actively engaged in the duties of his profession he still felt a deep interest in it, and in the development of the railway system of the country. He took great interest also in its commercial relations, and in all scientific and philosophic movements. He was a constant and systematic reader, and well informed in regard to the advances made in all such directions. His early acquaintance and friendship with Dr. Murdock had given him a deep and abiding

love for philosophic inquiry. During this year he wrote and published an article on the First Meridian, which was sent by Secretary Seward to the English government, but the latter did not think the time had then come to consider the subject.

In 1864 he closed his connection with the Quarry Company, as President, remaining as a Director, having successfully carried that concern through the troubles following the crisis of 1857, and the business difficulties and complications arising from the war. In June he was in Washington examining the report of the Committee on the Defences of the Eastern Frontier.

Shortly afterwards, by invitation, he joined the Cabinet and Congressional party that visited the Northeastern coast and the Northern boundary. This was a great pleasure to him, giving him not only the opportunity to examine personally the defences of the coast, but also enabling him to revisit the scenes of his early labors, where forty-five years before, as a lad of sixteen, he accompanied his father as assistant on the boundary survey.

He published shortly after a paper on the European and North American Railroad, in which he advocated the project of that company, and was offered the position of Chief Engineer on the road, which, however, he could not accept.

His views on the political situation at this time

are sufficiently exemplified by the following entry in his journal. On November 8, 1864, he writes:

"Though not well, went out to deposit my vote as a War Democrat, finding more congenial company among the supporters of Mr. Lincoln, but should have preferred General Dix."

In the month of December he published an article on the Marine Railway around Niagara.

In January, 1865, his carefully-prepared work, entitled "Words for the People," was issued from the press. Of this it has been said:

"It was an admirable work, comprising his views under three heads,—'Civil Government,' 'Government of the United States,' and 'Social Duties.' This work shows that Mr. Johnson, although in the main self-educated, possessed a clear, logical, and discriminating intellect, which fitted him to elaborate scientifically and convincingly the most abstruse as well as the simplest questions of national government."

In July of this year he visited the Falls of Niagara, and made a close and accurate examination of the ground on the route of the proposed ship canal and marine railway, and the same month attended the railroad convention at Detroit.

He was also engaged during the year as Consulting Engineer of the Middletown Water-Works, and wrote and published an able pamphlet on "The Navigation of the Lakes, and Navigable Communication therefrom to the Seaboard and to the Mississippi River."

In the early part of 1866 he made surveys at Lewiston and the Falls of Niagara, and in May was at Washington in the interest of the ship canal.

On the 14th of June he accepted the position of Engineer-in-Chief of the Northern Pacific Railroad, sixteen years after he first wrote, and twelve years after the publication of his first work on the subject. In this position he remained until November 1, 1870.

He was in Washington and New York during the most of the year in the active discharge of his duties, and was also engaged in the preparation of an historical essay on the early Norse settlements and the Newport Tower.

Though the demands upon his time and strength were incessant and wearing, yet it was a year full of gratification and of hope to him, in the consciousness that the great work to which he had given so much of valuable time and labor was at last taking form, and that he would be actively instrumental in carrying forward the vast railway system, the development of which he had watched and worked for for nearly forty years.

He was now sixty-three years old, and though not always strong in health, his mind was as active and vigorous, and his perseverance as indomitable as in his youth.

He was in Washington early in 1867, and in March of that year was offered by the President,

through the Secretary of the Interior, an appointment to examine the line of the Union Pacific Railway, and fix the limits of the mountain work and approaches, for which a higher subsidy was paid by the government. This he declined from motives of professional etiquette, as being in the employ of the Northern Pacific at the time.

He was much interested in the subject of the repeal of the Reciprocity Treaty with Canada (a treaty by which Canada gained much and this country lost more than she gained), and this year wrote and published his paper called the "Reciprocity Treaty." His personal influence and written arguments had much to do with securing the proposed object.

This year he made further examinations at Niagara for the materials necessary for his work on the "Falls of Niagara," then far advanced towards completion. This was a subject of great interest to him, but unfortunately his death occurred before the final revision of the work. His interest in and acquaintance with the science of geology was very great, and lasted through his life, and his practical knowledge of the subject greater than usual with those not making it a special life-study.

In December the directors passed a vote of thanks for a special report upon the Northern Pacific, prepared this year, and which was unusually comprehensive and interesting.

In February of 1868 he published a review and comparison of Pacific Railway routes, and in April read a paper on the subject of the Northern route before the New York Chamber of Commerce.

During this year he acted as Consulting Engineer of the Lake Ontario Shore-Line Railroad Company. In July he attended the railroad convention at Portland, Maine, by request of the Oswego Board of Trade.

In the fall he was in Minnesota, reviewing the work accomplished the preceding years on the line of the Northern Pacific, and also wrote a communication to the Board of Trade of Toronto.

In October, 1869, he attended the convention at Oswego, of which he was elected one of the Vice-Presidents, and appointed chairman of the Committee on Resolutions, which were drafted by him, and unanimously adopted.

The year was devoted to the discharge of his duties on the Northern Pacific Railroad, and in the early part of it he made an extensive tour through Minnesota, examining the country minutely.

In 1870 the work of survey, location, and construction was vigorously pushed forward, and in November of this year he resigned the position of Engineer-in-Chief, and accepted that of Consulting Engineer of the road. His successor, General W. Milnor Roberts, writes of this time as follows:

"At the period mentioned the Northern Pacific Railroad Company and Mr. Johnson became aware that the advance of years and declining health would prevent him from devoting such personal attention to the onerous duties involved in the prosecution of their undertaking as were deemed necessary to be performed by the head of the Engineer Department. I was invited to take the position of Chief Engineer, Mr. Johnson consenting to remain in the service of the company as Consulting Engineer, which office he filled till the day of his death.

"Let me embrace this opportunity to say that the Northern Pacific Railroad Company, and the American people who are to be so largely benefited by the construction of this important railroad thoroughfare across the northern portion of the continent, are more indebted to the intelligent forecast and untiring energy of Edwin F. Johnson than to any other individual."*

In 1870 he published a paper on the "Transcontinental Railways of the United States," completed a paper on currency and banking, and one upon the water-supply of New York City, and in 1871 published a paper on the broad and narrow gauge.

On the 12th of April, 1872, after a short illness, he died in the city of New York, with the interests of which, as well as those of the State and the whole country, his life-work had been so closely identified.

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* It is but right to add that General Roberts pays a just and well-merited tribute at the same time to those who gave so largely of their capital, their labor, and their time to this great undertaking, the final accomplishment of which is as sure as was that of the "Great Western" forty years ago.

A friend, writing of him after his death, describes him in the following just and touching words:

"While a youth he manifested a high order of intellectual ability, and, possessing an ardent love for scientific pursuits, he early attained a high standing as a student in the field of philosophic investigation. His mental powers seemed to crave no resting-time, but rather sought relaxation and enjoyment in constant, untiring effort.

"Possessing an unusual power to concentrate his mind upon whatever subject engaged his attention, he reached just conclusions successfully. Free from selfish aims or ambitious aspirations, he was ever ready to labor for the promotion of the interests of his fellow-man, uninfluenced in his work by considerations of private gain.

"There appeared to be scarcely any limit to the subjects which employed his studious investigation, upon many of which he has from time to time written and published valuable essays. He gave time and thought to geological phenomena, and again to subjects of finance, embracing a system of banking and currency, as best adapted to the needs of the country.

"Matters of historical, civil, and philosophical interest, as well as other departments of knowledge, also engaged his attention; but the result of much of these labors remains in manuscript. The cast of his mind was such as to enable him to apply whatever he gathered up from scientific sources to the practical purposes of life. He thus became not merely a theorist, but a man of practical fitness, qualified for the field of active duty.

"He labored both for the promotion of the social interests of the citizen and those connected with the various movements of the day, whether of public or private character."

The following extract from a letter written by

him in the dark days of 1837 may not be inapplicable to this time (1877), and shows the principle and character of the man:

"While the country lies paralyzed and prostrated by its own extravagance and folly, nature is doing everything in her power to revive and sustain the drooping spirits and resources of the people. Experience, it is said, is a dear school, and there is a certain class who will learn in no other. If the knowledge recently acquired will teach such to walk soberly and discreetly for the future, it will be worth probably all it has cost. The worst feature of it is that all the guilty do not suffer, and that many of the innocent do.

"The law of compensation is, however, constantly at work, and I doubt not each will get his just reward in the end. The virtues of honest industry and sobriety will, I think, be much higher prized hereafter than they have been for a time at least. Such has been the perverted and depraved state of sentiment, particularly among the higher (not the highest) classes, for two or three years past, that honest industry, frugality, and prudence have been associated in idea with the last degree of stolidity. A change has come over the spirit of this dream not unlike that which overtakes the intemperate when awakening in the morning after a night's debauch.

"If the present suffering shall produce repentance and reformation, the country will be greatly the gainer by what has happened. I sincerely hope that such will be the case."

A hope which we may all well entertain at this day; but the lessons of 1817, 1837, 1857, and 1877, coming at about the interval of a generation, would seem to teach us that men do not learn by the ex-

perience of their fathers, but that the dear lesson must be learned and paid for by themselves.

As illustrative of the spirit and temper of his life, and of the steadfast faith that made that life so true and manly, an extract is given from another letter, which, enforced by the example of his earnest work, may not be without its value to the young:

"Checkered as my life has been," he writes, "with the bright and dark shades of weal and woe, experience has convinced me that the good far outweighs the ill, and that with right intentions and exertions, faithfully and perseveringly made, all reasonable expectations may be realized, and that, however dark the present prospect, there is an enduring light above and beyond the cloud, which will shine out at last. I am, indeed, most firmly convinced that there are no circumstances so desperate which Providence may not eventually relieve; and I am equally convinced that under the divine blessing much, very much depends upon the faithful and diligent use of the means and powers which God has given us in averting or mitigating ills."

Thus he wrote when scarcely half of his life in time was passed, scarcely, indeed, a third of his active, useful life-work accomplished. During the remainder of his days he was called to pass through deeper darkness and over sunnier heights; through long nights of toil, weariness, and sorrow, through short days of rest and triumph. But through all his life was peaceful, through all the same steadfast faith and faithful endeavor marked his course till

the end came, and, literally, "in harness" and about the work the Master had given him to do, he went to his well-earned rest calmly and trustfully as a child falls asleep.

I have omitted, not without consideration, any mention of my father's religious convictions, or of his religious life, as the term is so often used, as if that were a distinct existence. I am advised, however, that it would be well to add a word on this subject. My father's religious convictions were the golden threads woven into the warp and woof of his life-work and thought, not distinct from but glorifying the whole texture.

He was for over forty years a member of the Protestant Episcopal Church, and for most of that time occupied positions of trust as vestryman and warden of Christ Church, afterward the Church of the Holy Trinity, Middletown, Connecticut.

To those who knew and loved him, and for whom alone this little volume is written, it is needless to say more.

NOTE IN ADDENDA.

PROFESSIONAL AND LITERARY WORKS OF EDWIN F. JOHNSON, C.E.

Treatise on Surveying	1825
Journal of March to Plattsburgh of Cadets, Norwich Military Institute	1825
Journal of same to Washington	1826
Journal of same to Niagara	1827
Tyler's Arithmetic Revised and Reviewed	1827
The Newellian Sphere	1828
Land Surveys	1828
Review of a Project for a Great Western Railway	1829
Method of Conducting the Canal Surveys of the State of New York	1832
The Epicycloid	1832
Report on Proposed Ontario and Hudson Ship Canal	1835
Appeal to the Representatives of the State of New York on Enlargement of Erie Canal	1836
Report, Auburn and Syracuse Railroad	1836
Same	1837
Cubical Quantities, Railroad and Canal	1837
Report, New York and Erie Railroad	1838
Report, New York and Albany	1838

Report, Ogdensburgh and Champlain 1838
Same 1839
Mountains in New York 1839
Reply to Mr. Emmons 1839
Report, New York and Albany 1839
Same 1840
Communication Relative to New York and Albany . . 1840
Address of Directors of same 1840
Tables of Quantities for Tracing Railroad Curves . . 1840
Railway System of the State of New York . . . 1840
Memorial to Legislature 1841
Width of Track 1842
Report, New York and Albany 1842
Same, November 1842
Statement Relative to same 1843
Report, Oswego and Syracuse Railroad 1846
Report, New York and Boston Railroad 1847
Same 1848
Report, Rock River Valley Union Railroad, Wisconsin . 1853
Gauge of Railways 1853
Railroad to the Pacific, Northern Route, its General Character, Relative Merits, etc. 1854
Charter and By-Laws, City of Middletown . . . 1857
Rules and Regulations of Public Schools, City of Middletown 1861
Report on Defences of Maine to Secretary of War . . 1862
Report on General Plan of Operations to same . . 1863
Cæsar's Bridge 1863
Ship Canal and Marine Railway at Niagara . . . 1864
First Meridian 1864
Words for the People 1865
The Reciprocity Treaty 1866
Navigation of the Lakes 1866

Report, Northern Pacific Railroad 1867
Our Pacific Railroads 1868
Niagara 1868
Report, Northern Pacific Railroad 1869
Water-Supply of New York 1870
Transcontinental Railways 1870
Historical Sketch of Norse Settlements and the Newport Tower 1870
Banking and the Currency 1871
Broad and Narrow Gauge 1871

Also numerous professional, scientific, philosophical, and political papers, contributed to reviews and journals during the space of forty-five years.

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